APPENDIX B

HYDROLOGIC AND HYDRAULIC HAND CALCULATIONS: INUNDATION ANALYSES

D'APPOLONIA

By DJF Date 12/15/99 Subject PADEP EAP - New Kernsville Dam Sheet No. 1 of 21
Chkd. By JWP Date 12/22/99 Inundation Analyses Proj. No. 993354

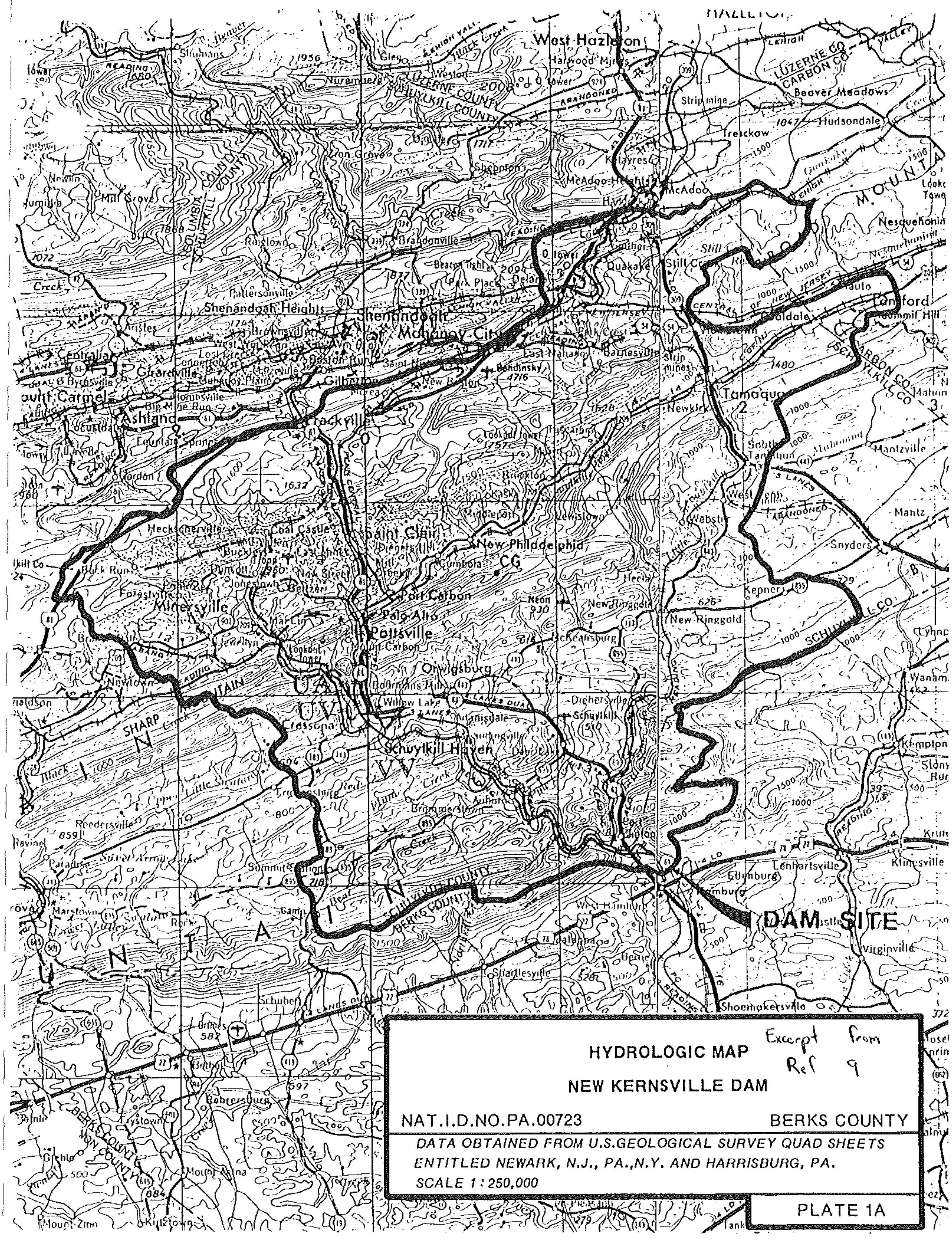
Purpose: Estimate limits of Inundation resulting from a hypothetical breach in the New Kernsville Dam on the Schuylkill River, Schuylkill Co., Pennsylvania. The Inundation Limits will be based on the following scenarios:

- Dam Breach Under PMF Conditions: The analyses will simulate routing of the PMP precipitation (In the dam's watershed) through the spillway and downstream reaches of the Schuylkill River.
  Analysis will then be performed to route the PMP precipitation through a breach in the dam: the breach will be assumed to begin developing at the maximum stage calculated for the dam under PMF conditions. The routing will be simulated for downstream reaches until it is predicted that the maximum stage under dam break conditions is less than 1 foot greater than under PMF (No dam breach) conditions. The dam breach scenario will be overtopping.

- Sunny Day Dam Breach: The analyses will simulate routing of a dam breach that occurs independently of a large precipitation event. The routing will be simulated for downstream reaches until the peak stage at a given section is within channel banks.

The inundation limits will be based on the highest peak stage and to the controlling downstream section as described for the above two scenarios.

Sheet 2/21



HYDROLOGIC MAP

NEW KERNSVILLE DAM

Excerpt from Ref 9

NAT.I.D.NO.PA.00723 BERKS COUNTY

DATA OBTAINED FROM U.S.GEOLOGICAL SURVEY QUAD SHEETS ENTITLED NEWARK, N.J., PA.,N.Y. AND HARRISBURG, PA.

SCALE 1 : 250,000

PLATE 1A

D'APPOLONIA

By DJF	Date 12/15/99	Subject PADEP EAP - New Kensington Dam	Sheet No. 3 of 21
Chkd. By JWP	Date 12/22/99	Inundation Analyses	Proj. No. 993354

Estimate PMP Depth for Dam Watershed

Watershed Area: 340 sq mi (See Attachment 1 for Watershed Plan)
200 sq mi < 340 sq mi < 1,000 sq mi Use Depth-Duration relationships for 200 and 1,000 sq mi watersheds from HMR No 51 (Ref 1)

Approximate PMP Depths:

Duration (HR)	Depth 200 sq mi (in)	Depth 1,000 sq mi (in)	Weighted Depth (340 sq mi) (in)	% of 6-hr PMP
6	18.4	13.0	17.4	100
12	21.6	16.7	20.7	119
24	24.1	20.2	23.4	134
48	28.2	23.2	27.3	157

Develop Watershed Characteristics (See Attachment 1, Topographic Plan of Watershed selected to estimate T_c)

1) Time of Concentration (See TR-55, Ref. 3, Chapter 3)

A) Sheet Flow, L = 300', s = 2.0%

$$T_t = \frac{0.007 (nL)^{0.8}}{(P_2)^{0.5} (S)^{0.4}}$$

Adopt $n = 0.24$ (Table 3-1 for Dense Grasses)
$P_2 = 2.95"$ (2-yr, 24 hr Rainfall for Schuylkill Co, Pa, from Ref 3, Figure B-3, See Sheet 5)

$T_t = 0.60$ hrs

B) Shallow Concentrated Flow, L = 3750', s = 1.3%

$V \simeq 1.8$ fps (From TR-55, Ref 3, Figure 3-1, Unpaved Watercourse)

$$T_t = \frac{3750'}{3600 * 1.8 \text{fps}} = 0.58 \text{ hrs}$$

C) Open Channel Flow Consider 4 lengths of channel
Using method described in the Handbook of Hydrology, Ref 4 Chpter 9

$$T_t = 0.0078\, L^{0.77}\, S^{-0.385} \qquad (9.42)$$

	Li (ft)	Si (%)	Tti (hrs)	
1	3068	7.82	0.17	(From head of watershed to Tuscarora)
2	12,700	1.70	0.90	(From Tuscarora to Bowkton)
3	112,000	0.27	9.85	(From Bowkton to Auburn Dam)
4	51,300	0.15	6.73	(Auburn Dam to New Kernsville Dam)
		Total	17.65	

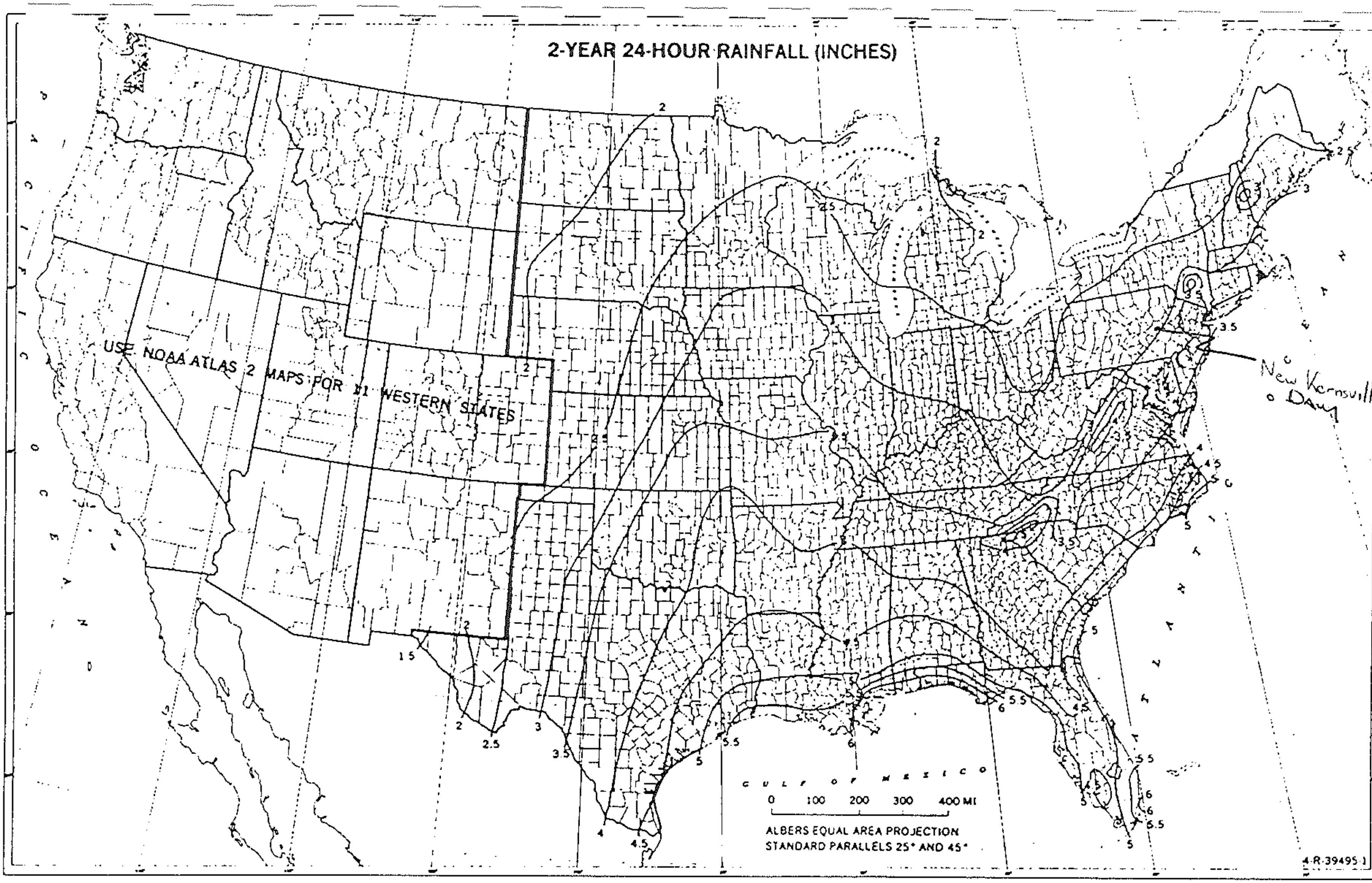


Figure B-3.—Two-year, 24-hour rainfall.

SHEET 5/21

D'APPOLONIA

By DJF Date 12/15/99 Subject PADEP EAP - New Kernsville Dam Sheet No. 6 of 21
Chkd. By JWP Date 12/22/99 Inundation Analyses Proj. No. 993354

1) <u>Time of Concentration con't</u>

From Sheet 4 $T_c = \sum T_t = 0.60 + 0.58 + 17.65$
$= 18.83$

$T_{lag} = 0.6\,T_c = 11.30$ hrs (See HEC-1 Manual, page 2-4)

2) <u>Curve Number</u> - Based on field reconnaissance the watershed is covered largely with woods, pasture, meadowlands and to a lesser extent strip mines. The soil associations for the watershed are as follows (Taken from Soil Survey of Schuylkill County, Pennsylvania Ref 10); See Sheet 7

Soil	Hydrologic Group	
Leck Kill	B	
Berks	C	Use Hydrologic Group C
Weikert	C/D	
Dekalb	C	
Buchanan	C	
Hazleton	B	

From TR-55 (Ref 3) Table 2-2c, for Hydrologic Group C the following CN's are indicated

Pasture - 74
Woods - 70
Meadow - 71

Select CN = 72

Hydraulic Characteristics - Elevation - Storage and - Discharge Relationships
Calculated based on dimensions taken from New Kernsville Dam Phase I Inspection Report (Ref 9)

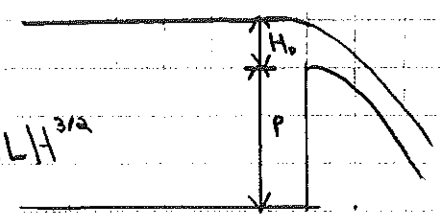
- Elevation - Storage

Elevation (ft)	Storage (Ac-ft)	
350	0	} Assumed no storage below stream bed El. 350
383	583	} Taken from Phase I Inspection Report
393.88	1250	
400	2191	} Measured from USGS Map See Sheet 8A
420	7075	

- Elevation - Discharge - Calculated using methods from Design of Small Dams, USBR, 2nd ed Ref. 8

P = 30 ft (From Ref 9 Plate 3)
H_o = 399.88 ft - 383 ft = 16.88 ft
P/H_o = 1.78
C_o = 3.93 (Ref 8, Fig. 249 p. 378)

$Q = CLH^{3/2}$



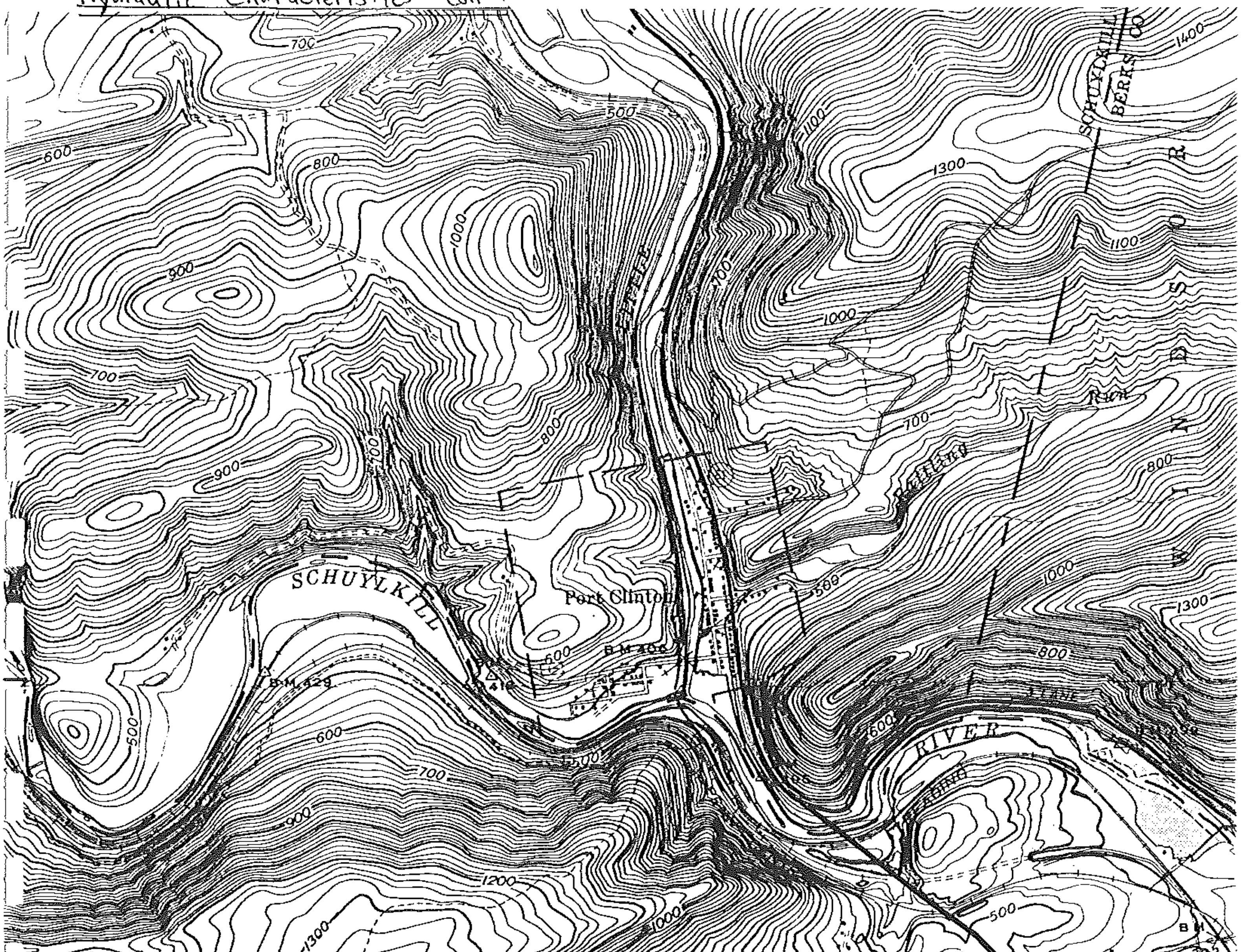
WS Elevation (ft)	H ft	$\frac{H}{H_o}$	$\frac{C}{C_o}$*	C	L (ft)	Q cfs
383	0					
384	1	0.06	0.81	3.18	600	1,908
385	2	0.12	0.83	3.26		5,533
387	4	0.24	0.865	3.40		16,320
390	7	0.41	0.90	3.54		39,337
392	9	0.53	0.93	3.65		59,130
395	12	0.71	0.96	3.77		94,029
399.88	16.88	1.00	1.00	3.93		163,532
405	22	1.30	1.04	4.09		253,226
410	27	1.60	1.07	4.21		354,388

* C/Co From Ref 8, Fig 250, p 378

D'APPOLONIA

By DJF Date 12/15/99 Subject PADEP EAP - New Kernsville Dam Sheet No. 8A of 21
Chkd. By JWP Date 01/04/00 Inundation Analyses Proj. No. 993354

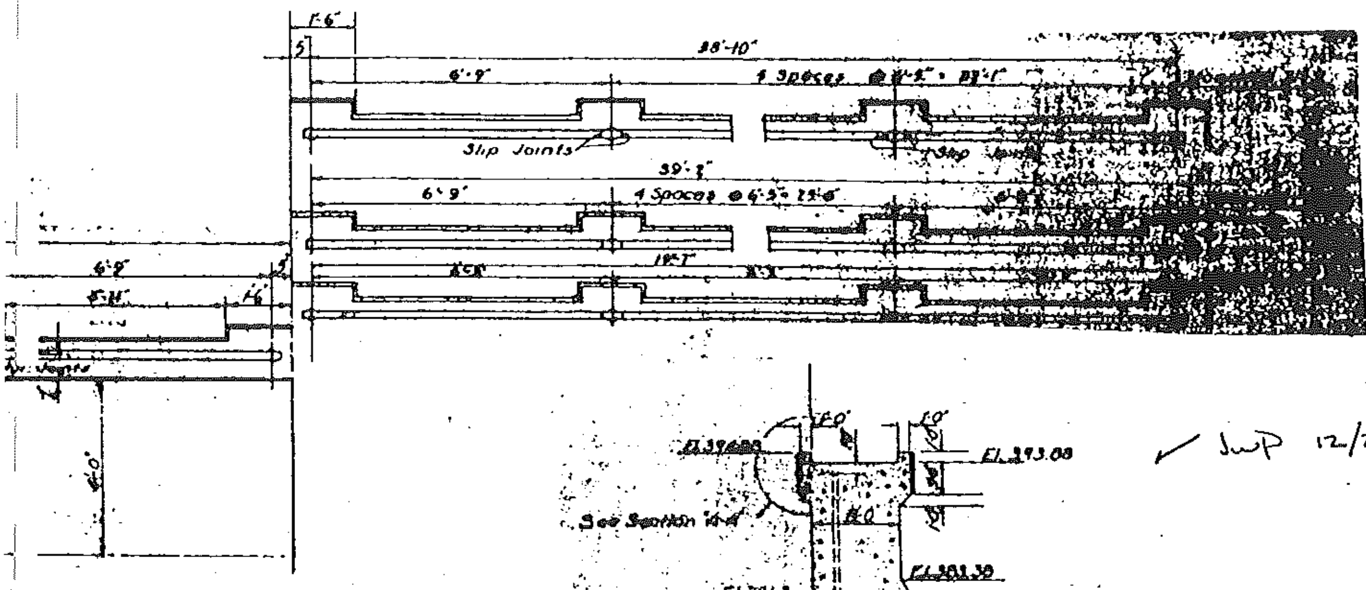
Hydraulic Characteristics con't

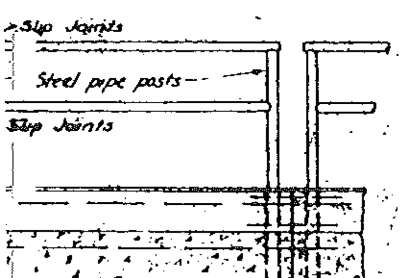


Elevation (ft)	Area (Ac)	Avg Area (Ac)	Culm. Volume (Ac-ft)
383	44.5		
400	148.6	94.6	2191*
420	354.5	244.2	7075

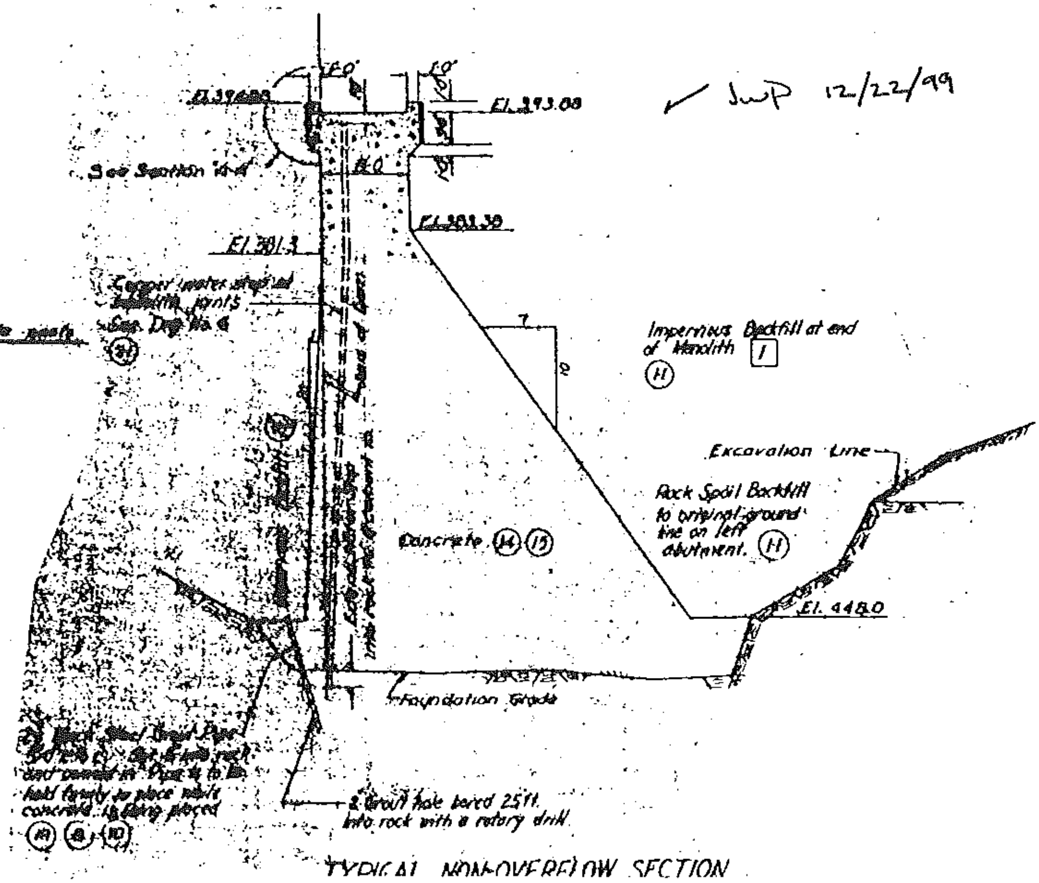
* Includes 583 Ac-ft below El 383 ft see sheet 8

Sheet 4/21

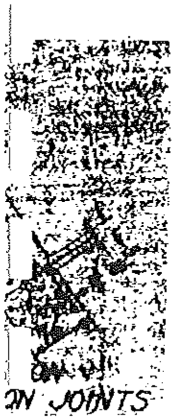




✓ JWP 12/22/99



FLOW MONOLITHS



<u>Overtopping Characteristics</u>

Overall Length = 1,600 ft (Ref 8) – 600 ft (Weir width) = 1000 ft at El 393.88 ft

C = 2.65 for breadth = 8 ft → From Brater & King, Handbook of Hydraulics, McGraw-Hill, 1976 Table 5-3 p 5-40

DETAILS OF NON-OVERFLOW ~~SECTIONS~~

NEW KERNSVILLE DAM Excerpt from Ref 8

NAT. I.D.NO.PA.00723 — BERKS COUNTY

DATA OBTAINED FROM BUREAU OF COMPLETED PROJECTS, SCHUYLKILL RIVER OFFICE, CONTRACT NO. 10, SHEET NO. 7, DATED 12/29/50

PLATE 8

D'APPOLONIA

By DJF Date 12/14/99 Subject PADEP EAP - New Kensville Dam Sheet No. 10 of 21
Chkd. By JWP Date 12/22/99 Inundation Analyses Proj. No. 993354

Downstream Channel Cross Sections (Refer to Sheets 12, 13, + 14)

- Section 1, L = 5000' s = 0.57%

x, ft	0	220	677	725	755	803	1360	2040
y, El., ft	420	380	371.3	363.6	363.6	371.3	380	420

manning's n 0.1 0.045 0.1

- Section 2, L = 7700' s = 0.19%

x, ft	0	1600	1640	1700	1860	1920	2800	2900
y, El, ft	380	360	344.4	334.4	334.4	344.4	360	380

manning's n 0.1 0.045 0.1

- Section 3, L = 7600' s = 0.17%

x, ft	0	700	870	900	990	1020	1520	2350
y, El, ft	380	340	330	320	320	330	340	360

manning's n 0.1 0.045 0.1

- Section 4, L = 6200' s = 0.10%

x, ft	0	170	520	580	650	700	1590	3250
y, El., ft	380	340	323	313	313	323	340	380

manning's n 0.1 0.045 0.1

Downstream Channel Cross-Sections Con't

- Section (5), L= 8400', s= 0.10%

x, ft	0	1580	1880	1940	2020	2080	2460	2640
y, El., ft	360	320	312	302	302	312	320	360

manning's n 0.1 0.045 0.1

- Section (6), L= 7100', s= 0.14%

x, ft	0	240	1500	1550	1850	1900	2050	2130
y, El, ft	340	320	303	293	293	303	320	340

manning's n 0.1 0.045 0.1

- Section (7), L= 7200' s= 0.14%

x, ft	0	100	1100	1160	1340	1400	1590	1750
y, El, ft	340	320	295.6	285.6	285.6	295.6	320	340

manning's n 0.1 0.045 0.1

- Section (8), L= 10,000 s= 0.14%

x, ft	0	280	800	860	1140	1200	1720	1900
y, El, ft	320	300	282.8	272.8	272.8	282.8	300	320

manning's n 0.1 0.045 0.1

D'APPOLONIA

By DJF Date 12/14/99 Subject PADEP EAP - New Kernsville Dam Sheet No. 12 of 21
Chkd. By JWP Date 12/22/99 Inundation Analyses Proj. No. 993354

Downstream Channel Cross-Sections Con't

- Section (9), L = 9900 s = 0.14%

x, ft	0	200	1700	1760	1940	2000	2500	5700
y, El, ft	320	300	270	260	260	270	300	320

manning's n 0.1 0.045 0.1

SEE NOTE BELOW

- Section (10), L = 13,400 s = 0.12%

x, ft	0	300	350	400	650	700	850	1320
y, El, ft	300	260	250	240	240	250	260	300

manning's n 0.1 0.045 0.1

- Section (11), L = 13,400 s = 0.12%

x, ft	0	420	520	580	800	860	950	2050
y, El, ft	300	260	234	224	224	234	260	300

manning's n 0.1 0.045 0.1

Note: Just below Reach (9), Maiden Creek Meets the Schulykill River - The HEC-1 Analyses Inundation (PMF Case + Dambreak Case) flow contribution from Maiden Creek of 15,050 cfs - Equivalent to the 100-yr Peak Discharge taken from the Flood Insurance Study for Berks County (See Sheets 12A and 12B

EXCERPT FROM REF. 11
VOL. 1 OF 4

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
LITTLE CACOOSING CREEK (continued)					
At Bell Alto Road (Township Route 379)	0.65	*	*	320	*
LITTLE LEHIGH CREEK					
At a point approximately 1.02 mile downstream of CONRAIL	7.95	*	*	1,520	*
At Legislative Route 06119 (Main Street)	6.42	*	*	1,250	*
At a point approximately 500 feet upstream of Legislative Route 06119 (Main Street)	3.57	*	*	780	*
At a point approximately 20 feet downstream of pond at Township Route 612 (Longsdale Road)	2.94	*	*	660	*
LITTLE MANATAWNY CREEK					
At confluence with Manatawny Creek	12.1	*	*	2,580	*
Upstream of confluence of Furnace Creek	6.06	*	*	1,560	*
Upstream of State Route 662	5.16	*	*	1,390	*
At Legislative Route 197 (Frieden's Road)	4.40	*	*	1,230	*
At a point approximately 870 feet downstream of Basket Road	2.15	*	*	750	*
LITTLE SACONY CREEK					
At confluence with Sacony Creek	1.42	*	*	560	*
LITTLE SWATARA CREEK					
At a point approximately 0.21 mile downstream of confluence of Crosskill Creek	57.9	*	*	13,700	*
At State Route 645	36.0	*	*	10,230	*
At Bordner Road	25.1	*	*	8,200	*
At Legislative Route 06007	18.1	*	*	6,700	*
At Gravel Pit Road	13.0	*	*	5,460	*
MAIDEN CREEK-ONTELAUNEE CREEK					
At State Route 143	157	*	*	15,050	*
Upstream of confluence of Sacony Creek	102	*	*	11,400	*

*Data not available

EXCERPT FROM REF. 11
VOL. 1 OF 4

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Laurel Run Alternate Branch								
A	40[1]	97[4]	353	8.4	343.0	343.0	343.6	0.6
Little Cacoosing Creek								
A	6,975[2]	50	108	6.7	387.0	387.0	387.3	0.3
B	8,025[2]	35	79	6.9	405.9	405.9	406.8	0.9
Maiden Creek								
A	1,250[3]	128	2,252	11.0	268.3	268.2[5]	268.3	0.1
B	2,950[3]	270	3,442	9.0	268.3	268.2[5]	268.5	0.3
C	5,000[3]	318	3,334	8.0	270.0	270.0	270.4	0.4
D	7,150[3]	166	2,662	10.0	271.9	271.9	272.0	0.1
E	9,500[3]	169	3,195	8.0	276.0	276.0	277.0	1.0
F	11,300[3]	143	2,509	10.0	277.2	277.2	277.9	0.7
G	11,600[3]	314	4,474	6.0	278.7	278.7	279.4	0.7
H	13,100[3]	463	5,326	5.0	279.9	279.9	280.3	0.4
I	14,800[3]	297	4,083	6.0	281.1	281.1	282.0	0.9
Manatawny Creek								
A	14,900[3]	74	814	17.0	156.9	156.9	157.9	1.0
B	16,875[3]	134	1,948	7.0	164.3	164.3	165.3	1.0
C	18,675[3]	98	1,261	11.0	166.9	166.9	167.7	0.8
D	20,950[3]	159	1,709	14.0	172.3	172.3	172.3	0.0
E	23,600[3]	78	911	15.0	175.8	175.8	175.8	0.0
F	25,100[3]	121	1,656	8.0	178.1	178.1	179.1	1.0
G	27,500[3]	78	967	14.0	181.8	181.8	182.8	1.0
H	29,200[3]	207	1,740	11.0	187.1	187.1	187.7	0.6

[1]Feet above confluence with Laurel Run
[2]Feet above Township of South Heidelberg downstream corporate limits
[3]Feet above confluence with Schuylkill River
[4]Combined Laurel Run/Laurel Run Alternate Branch floodway
[5]Elevation computed without consideration of backwater effects from Schuylkill River

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY
BERKS COUNTY, PA
(ALL JURISDICTIONS)

FLOODWAY DATA

LAUREL RUN ALTERNATE BRANCH - LITTLE CACOOSING CREEK

FLOODING SOURCE | FLOODWAY | BASE FLOOD WATER SURFACE ELEVATION

Downstream Channel Sections Con't

- Section 12 , L=7500' , s= 0.1%

x, ft.	0	280	400	460	920	980	1450	1500
y, El ft.	280	240	226	216	216	226	240	260

manning's n 0.10 0.045 0.10

Excerpts from HEC-1 Course Manual, Pennsylvania State University

A. Suggested ranges of values for the breach parameters.

1. Breach width (BRWID) Bottom Width

   - Earth Dam : $\frac{HD}{2}$ < BRWID < 3HD (HD=dam height).

     May be a function of reservoir volume also.

   - Concrete gravity : BRWID = a multiple of $B_w \approx 300$ monolith widths.

   - Concrete arch : Set BRWID such that total failure is modeled.

2. Side Slopes of breach (z)

   - Earth : 0 < z < 1

   - Concrete gravity : z = 0

   - Concrete arch : z = valley wall slope

3. Failure time (TFAIL) in hours.

   - Earth : 0.5 < TFAIL < 4

   - Concrete gravity : 0.1 < TFAIL < 0.5

   - Concrete arch : near instantaneous (say TFAIL = 0.1)

4. Pool level at which failure begins (FAILEL).

   - Earth : 1 to 5 ft. above top of dam.

   - Concrete gravity : 10-50 ft. above top of dam. May use design information or stability analysis.

   - Concrete arch : same as for concrete gravity.

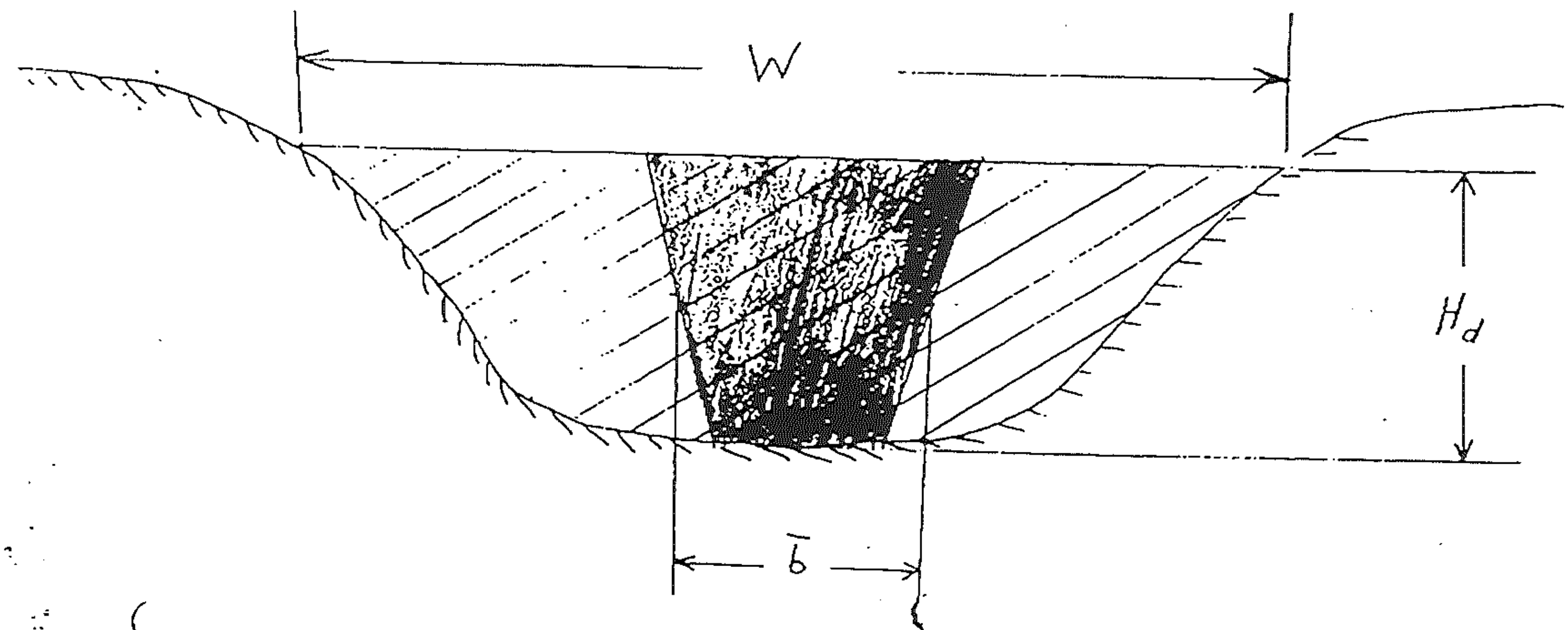
<u>Select Breach Parameters</u> - Based on guidlines provided to D'Appolonia for dam breach analyses using HEC-1 for concrete gravity dams

Breach Width = $\frac{1}{2}$ Dam Width = 300', Side Slopes = 0, Time to fail = 0.1 hr
Breach Initiated at maximum pool level determined from the PMF case, with the base of the breach assumed @ El 350 ft (bottom of reservior storage, from sheet 8/21)

SHEET 17/21

Excerpt from "Inspection and Evaluation of Safety of Non-Federal Dams" Course Manual

TYPE OF DAM	AVG. BREACH WIDTH(b)	TIME OF FAILURE(τ)
EARTH (well constructed)	$H_d < b < 3H_d$	$.5 \le \tau \le 3$
EARTH	$H_d < b < 3H_d$	$.1 \le \tau \le .5$
SLAG PILE	$b \ge 0.8$ W	$\tau \le .2$
CONCRETE (Gravity)	$b \le 0.5$ W	$\tau \le .2$
CONCRETE (Arch)	$b \ge 0.8$ W	$\tau \le .1$



D'APPOLONIA

By DJF Date 12/22/99 Subject PADEP EAP - New Kernsville Dam Sheet No. 18 of 21
Chkd. By JWP Date 12/23/99 Inundation Analyses Proj. No. 993354

Inundation Analyses - Computer Program HEC-1 was used to evaluate downstream inundation. The following analyses were performed (See Attachment 2 for runs):

Run # 1 PMF Routing: The PMF was routed through the dam and downstream channel reaches.

Run # 2 Dam Break under PMF Conditions: Breach is assumed to develop at peak reservior level from Run # 1. The portion of the inflow hydrograph from Run # 1 (After Peak Reservior Level is Reached) was used as the inflow condition.

Run # 3 Sunny Dam Break: Breach is initiated with Reservior Level at El. 383.4 (Slightly above spillway elevation) at Normal Pool El. 383.5 ft.

A summary table of Peak Flows and Peak Stages for the downstream reaches considered is presented on Sheet 19.

MODELLING OF DAM BREAK UNDER PMF CONDITIONS

FROM "DAM" HYDROGRAPH, PEAK STAGE (EL 402.27) OCCURS AT TIME ORDINATE 102 (03AUG 0230 HRS) WITH Q=269,930CFS. FOR DAM BREAK UNDER PMF CONDITIONS CASE, TIME INTERVAL REQUIRED TO ADEQUATELY MODEL BREACH (I.E., 2MINUTES) DOES NOT PERMIT THE FULL PMF INFLOW TO BE MODELLED. IF SOME PORTION OF THE PMF IS NOT ACCOUNTED FOR IN THE DAM BREAK UNDER PMF CONDITIONS CASE, HEC-1 WILL MODEL THE DOWNSTREAM SECTIONS AS "EMPTY" AT THE START OF THE ANALYSIS. THEREFORE, INCLUDE A PORTION OF PMF INFLOW IN MODEL PRIOR TO PEAK STAGE FOR PMF CASE (I.E., STAGE TAKEN TO INITIATE BREACH IN DAM BREAK ANALYSIS): TAKE STARTING TIME AS 02AUG 2200 HRS (4.5 HOURS PRIOR TO PEAK STAGE) WITH RESERVOIR LEVEL AT EL 399.6 FOR DAM BREAK SIMULATION (SEE "DAM" HYDROGRAPH FROM RUN#1), FOR INFLOW HYDROGRAPH, USE THE HYDROGRAPH (TAKEN FROM "IN" HYDROGRAPH FROM RUN#1) ON SHEETS 18B + 18C.

Sheet 18B/21

Inflow hydrograph

2 AUG 1130	72	.28	.03	.24	25872.	*	5 AUG 1430	222	.00	.00	.00	0.
2 AUG 1200	73	.28	.03	.24	27269.	*	5 AUG 1500	223	.00	.00	.00	0.
2 AUG 1230	74	.87	.09	.78	29007.	*	5 AUG 1530	224	.00	.00	.00	0.
2 AUG 1300	75	.87	.08	.79	31067.	*	5 AUG 1600	225	.00	.00	.00	0.
2 AUG 1330	76	1.04	.08	.96	33537.	*	5 AUG 1630	226	.00	.00	.00	0.
2 AUG 1400	77	1.04	.07	.97	36468.	*	5 AUG 1700	227	.00	.00	.00	0.
2 AUG 1430	78	1.31	.08	1.23	39901.	*	5 AUG 1730	228	.00	.00	.00	0.
2 AUG 1500	79	1.31	.07	1.24	43908.	*	5 AUG 1800	229	.00	.00	.00	0.
2 AUG 1530	80	1.59	.07	1.52	48553.	*	5 AUG 1830	230	.00	.00	.00	0.
2 AUG 1600	81	5.03	.16	4.87	54553.	*	5 AUG 1900	231	.00	.00	.00	0.
2 AUG 1630	82	1.22	.03	1.19	61274.	*	5 AUG 1930	232	.00	.00	.00	0.
2 AUG 1700	83	1.22	.03	1.19	69419.	*	5 AUG 2000	233	.00	.00	.00	0.
2 AUG 1730	84	.96	.02	.94	78623.	*	5 AUG 2030	234	.00	.00	.00	0.
2 AUG 1800	85	.96	.02	.94	88873.	*	5 AUG 2100	235	.00	.00	.00	0.
2 AUG 1830	86	.13	.00	.13	100126.	*	5 AUG 2130	236	.00	.00	.00	0.
2 AUG 1900	87	.13	.00	.13	112203.	*	5 AUG 2200	237	.00	.00	.00	0.
2 AUG 1930	88	.13	.00	.13	125422.	*	5 AUG 2230	238	.00	.00	.00	0.
2 AUG 2000	89	.13	.00	.13	139135.	*	5 AUG 2300	239	.00	.00	.00	0.
2 AUG 2030	90	.13	.00	.13	153792.	*	5 AUG 2330	240	.00	.00	.00	0.
2 AUG 2100	91	.13	.00	.13	168781.	*	6 AUG 0000	241	.00	.00	.00	0.
2 AUG 2130	92	.13	.00	.13	184003.	*	6 AUG 0030	242	.00	.00	.00	0.
2 AUG 2200	93	.13	.00	.13	199207.	*	6 AUG 0100	243	.00	.00	.00	0.
2 AUG 2230	94	.13	.00	.13	213725.	*	6 AUG 0130	244	.00	.00	.00	0.
2 AUG 2300	95	.13	.00	.13	226766.	*	6 AUG 0200	245	.00	.00	.00	0.
2 AUG 2330	96	.13	.00	.13	238705.	*	6 AUG 0230	246	.00	.00	.00	0.
3 AUG 0000	97	.13	.00	.13	248463.	*	6 AUG 0300	247	.00	.00	.00	0.
3 AUG 0030	98	.00	.00	.00	256665.	*	6 AUG 0330	248	.00	.00	.00	0.
3 AUG 0100	99	.00	.00	.00	262778.	*	6 AUG 0400	249	.00	.00	.00	0.
3 AUG 0130	100	.00	.00	.00	266974.	*	6 AUG 0430	250	.00	.00	.00	0.
3 AUG 0200	101	.00	.00	.00	269466.	*	6 AUG 0500	251	.00	.00	.00	0.
3 AUG 0230	102	.00	.00	.00	269880.	*	6 AUG 0530	252	.00	.00	.00	0.
3 AUG 0300	103	.00	.00	.00	269098.	*	6 AUG 0600	253	.00	.00	.00	0.
3 AUG 0330	104	.00	.00	.00	266818.	*	6 AUG 0630	254	.00	.00	.00	0.
3 AUG 0400	105	.00	.00	.00	263511.	*	6 AUG 0700	255	.00	.00	.00	0.
3 AUG 0430	106	.00	.00	.00	258577.	*	6 AUG 0730	256	.00	.00	.00	0.
3 AUG 0500	107	.00	.00	.00	252434.	*	6 AUG 0800	257	.00	.00	.00	0.
3 AUG 0530	108	.00	.00	.00	245428.	*	6 AUG 0830	258	.00	.00	.00	0.
3 AUG 0600	109	.00	.00	.00	237547.	*	6 AUG 0900	259	.00	.00	.00	0.
3 AUG 0630	110	.00	.00	.00	228944.	*	6 AUG 0930	260	.00	.00	.00	0.
3 AUG 0700	111	.00	.00	.00	219612.	*	6 AUG 1000	261	.00	.00	.00	0.
3 AUG 0730	112	.00	.00	.00	209868.	*	6 AUG 1030	262	.00	.00	.00	0.
3 AUG 0800	113	.00	.00	.00	199522.	*	6 AUG 1100	263	.00	.00	.00	0.
3 AUG 0830	114	.00	.00	.00	188837.	*	6 AUG 1130	264	.00	.00	.00	0.
3 AUG 0900	115	.00	.00	.00	177877.	*	6 AUG 1200	265	.00	.00	.00	0.
3 AUG 0930	116	.00	.00	.00	166655.	*	6 AUG 1230	266	.00	.00	.00	0.
3 AUG 1000	117	.00	.00	.00	155592.	*	6 AUG 1300	267	.00	.00	.00	0.
3 AUG 1030	118	.00	.00	.00	145207.	*	6 AUG 1330	268	.00	.00	.00	0.
3 AUG 1100	119	.00	.00	.00	135197.	*	6 AUG 1400	269	.00	.00	.00	0.
3 AUG 1130	120	.00	.00	.00	126119.	*	6 AUG 1430	270	.00	.00	.00	0.
3 AUG 1200	121	.00	.00	.00	117712.	*	6 AUG 1500	271	.00	.00	.00	0.
3 AUG 1230	122	.00	.00	.00	109917.	*	6 AUG 1530	272	.00	.00	.00	0.
3 AUG 1300	123	.00	.00	.00	102658.	*	6 AUG 1600	273	.00	.00	.00	0.
3 AUG 1330	124	.00	.00	.00	95869.	*	6 AUG 1630	274	.00	.00	.00	0.
3 AUG 1400	125	.00	.00	.00	89617.	*	6 AUG 1700	275	.00	.00	.00	0.
3 AUG 1430	126	.00	.00	.00	83679.	*	6 AUG 1730	276	.00	.00	.00	0.
3 AUG 1500	127	.00	.00	.00	78267.	*	6 AUG 1800	277	.00	.00	.00	0.
3 AUG 1530	128	.00	.00	.00	73159.	*	6 AUG 1830	278	.00	.00	.00	0.
3 AUG 1600	129	.00	.00	.00	68318.	*	6 AUG 1900	279	.00	.00	.00	0.
3 AUG 1630	130	.00	.00	.00	63708.	*	6 AUG 1930	280	.00	.00	.00	0.
3 AUG 1700	131	.00	.00	.00	59374.	*	6 AUG 2000	281	.00	.00	.00	0.

3	AUG	1730	132	.00	.00	.00	55356.	*	6	AUG	2030	282	.00	.00	.00	0.
3	AUG	1800	133	.00	.00	.00	51540.	*	6	AUG	2100	283	.00	.00	.00	0.
3	AUG	1830	134	.00	.00	.00	47947.	*	6	AUG	2130	284	.00	.00	.00	0.
3	AUG	1900	135	.00	.00	.00	44565.	*	6	AUG	2200	285	.00	.00	.00	0.
3	AUG	1930	136	.00	.00	.00	41518.	*	6	AUG	2230	286	.00	.00	.00	0.
3	AUG	2000	137	.00	.00	.00	38727.	*	6	AUG	2300	287	.00	.00	.00	0.
3	AUG	2030	138	.00	.00	.00	36097.	*	6	AUG	2330	288	.00	.00	.00	0.
3	AUG	2100	139	.00	.00	.00	33627.	*	7	AUG	0000	289	.00	.00	.00	0.
3	AUG	2130	140	.00	.00	.00	31316.	*	7	AUG	0030	290	.00	.00	.00	0.
3	AUG	2200	141	.00	.00	.00	29236.	*	7	AUG	0100	291	.00	.00	.00	0.
3	AUG	2230	142	.00	.00	.00	27261.	*	7	AUG	0130	292	.00	.00	.00	0.
3	AUG	2300	143	.00	.00	.00	25395.	*	7	AUG	0200	293	.00	.00	.00	0.
3	AUG	2330	144	.00	.00	.00	23630.	*	7	AUG	0230	294	.00	.00	.00	0.
4	AUG	0000	145	.00	.00	.00	21997.	*	7	AUG	0300	295	.00	.00	.00	0.
4	AUG	0030	146	.00	.00	.00	20503.	*	7	AUG	0330	296	.00	.00	.00	0.
4	AUG	0100	147	.00	.00	.00	19087.	*	7	AUG	0400	297	.00	.00	.00	0.
4	AUG	0130	148	.00	.00	.00	17758.	*	7	AUG	0430	298	.00	.00	.00	0.
4	AUG	0200	149	.00	.00	.00	16510.	*	7	AUG	0500	299	.00	.00	.00	0.
4	AUG	0230	150	.00	.00	.00	15392.	*	7	AUG	0530	300	.00	.00	.00	0.

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TOTAL RAINFALL = 27.32, TOTAL LOSS = 4.17, TOTAL EXCESS = 23.15

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	149.50-HR
269880.	50.50	(CFS)	260561.	172949.	70414.	33974.
		(INCHES)	7.125	18.918	23.106	23.148
		(AC-FT)	129204.	343039.	418990.	419757.

CUMULATIVE AREA = 340.00 SQ MI

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          *            *
12 KK     *     DAM    *        STAGE DISCHARGE CURVE
          *            *
          **************
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ELEVATION VS. STORAGE AND DISCHARGE

14 KO OUTPUT CONTROL VARIABLES

IPRNT	1	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

HYDROGRAPH ROUTING DATA

15 RS STORAGE ROUTING

NSTPS	1	NUMBER OF SUBREACHES
ITYP	ELEV	TYPE OF INITIAL CONDITION
RSVRIC	383.00	INITIAL CONDITION
X	.00	WORKING R AND D COEFFICIENT

16 SV STORAGE .0 583.0 1250.0 2191.0 7075.0

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D'APPOLONIA

By DJF Date 12/15/99 Subject PADEP FAP - New Kernsville Dam Sheet No. 21 of 21
Chkd. By ____ Date ________ Inundation Analyses Proj. No. 993354

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